CLAIMS:

I claim:

1. An electrochemical device, comprising:

a cell with a plurality of discrete cathodic or anodic regions at which one or more electrochemical reactions occurs; and

means for causing the one or more electrochemical reactions at each of the plurality of discrete regions whereby each of the one or more electrochemical reactions is measurable and quantifiable.

2. The device of claim 1, wherein the means for causing the one or more electrochemical reactions that occur at each of the plurality of discrete regions to be different.

3. The device of claim 1, wherein the means for causing the one or more electrochemical reactions at each of the plurality of discrete regions causes the one or more electrochemical reactions to proceed simultaneously and for the same amount of time.

4. The device of claim 3, wherein the means for causing the one or more electrochemical reactions cause the one or more electrochemical reactions to occur simultaneously at different current densities at each of the discrete regions.

5. The device of claim 4, wherein the one or more electrochemical reactions cause a discrete deposit at each of the discrete regions, each discrete deposit being a function of the current density at the discrete region of the discrete deposit.

6. The device of claim 4, wherein each of the discrete regions is disposed on a same substrate.

7. The device of claim 5, including:

means for measuring the current density at each of the discrete regions while the one or more electrochemical reactions occur simultaneously at different current densities at each of the discrete regions.

8. The device of claim 7, including:

means for measuring the voltage at each of the discrete regions while the one or more electrochemical reactions occur simultaneously at different current densities at each of the discrete regions.

9. The device of claim 1, wherein the electrochemical reactions occur at different reaction rates that take place sequentially at the distinctly different anodic or cathodic regions.

10. The device of claim 1, wherein the electrochemical reactions occur at different reaction rates that vary in a periodic fashion at the distinctly different anodic or cathodic regions.

11. An electrochemical device for simultaneously forming a plurality of electroplated deposits at a plurality of discrete cathodic or anodic regions at which one or more electrochemical reactions occurs; the electrochemical device comprising:

a cell and a plated, segmented substrate, the substrate having disposed therebetween a plurality of discrete cathodic or anodic regions at which one or more electrochemical reactions occurs.

12. The electrochemical device of claim 11 wherein the substrate is constructed of a dielectric material selected from the group comprising silicon, glass and plastic material.

13. The electrochemical device of claim 12 wherein the substrate has a conductive seed layer formed thereon, the conductive seed layer being constructed of a material selected from the group comprising of copper, nickel, brass, gold, and other conductive materials compatible with an electrochemical process.

14. The electrochemical device of claim 13 wherein the substrate has a conductive seed layer formed as a continuous conductive layer.

15. The electrochemical device of claim 14 wherein the substrate has a conductive seed layer formed by a vapor phase process, an electroless process, by lamination or gluing a conductive film onto the dielectric substrate.

16. The electrochemical device of claim 15 wherein the substrate has a conductive seed layer segmented into a plurality of discrete, electrically isolated sections.

17. The electrochemical device of claim 16 wherein the substrate has a conductive seed layer is segmented into a plurality of discrete, electrically isolated sections by grooves cut through the conductive seed layer between each of the discrete sections.

18. The electrochemical device of claim 11, wherein the substrate comprises a patterned printed circuit board having a pattern thereon that provides the plurality of discrete electrically isolated sections.

19. The electrochemical device of claim 14 wherein each of the plurality of discrete electrically isolated sections has a separate electrical contact attached thereto.

20. The electrochemical device of claim 19 further including means for directing a different current through separate current paths to or from each of the separate electrical contacts.

21. The electrochemical device of claim 20 further including resistors in each of the separate current paths to control the current to each separate electrical contact.

22. The electrochemical device of claim 1 wherein one or more of the discrete cathodic regions or anodic regions forms a reference electrode adapted to measure the potential in the electrolyte at the position where the reference electrode is located.

23. The electrochemical device of claim 11 wherein the cell incorporates an enclosure with a plurality of cavities therein, each cavity corresponding to one of the discrete cathodic or

anodic regions whereby when the cell is assembled each of the discrete cathodic or anodic regions is exposed to an electrolyte and ionic current.

24. The electrochemical device claim 23 wherein the depth of the cavities ensure a uniform current density across the discrete cathodic or anodic regions formed on the substrate.

25. The electrochemical device of claim 11 wherein a counter electrode is not segmented and is disposed at a fixed distance from the substrate.

26. The electrochemical device of claim 25 wherein the substrate is a cathode, and the counter electrode is an anode formed of a material on which oxygen can evolve.

27. The electrochemical device of claim 26 wherein the anode is formed of a conductor selected from the group comprising platinum, gold, titanium, titanium coated with iridium oxide, ruthenium oxide, platinum, lead, or silver-lead alloy, and solubles such as copper and nickel.

28. The electrochemical device of claim 11 wherein:

the substrate is selected from the group including a segmented rotating disk electrode and a rotating segmented disk electrode surrounded by a ring electrode.

29. The electrochemical device of claim 11 wherein:

a central circular electrode that is not segmented; and

the substrate is a surrounding electrode that is segmented to provide a plurality of electrodes.

30. The electrochemical device of claim 11 further including means for agitating or circulating the electrolyte, the means for agitating or circulating selected from the group comprising inert gas for agitation, air bubbling for agitation, a stirrer, and a pump.

31. A process for determining the quality of electroplated deposits comprising:

simultaneously depositing a plurality of discrete deposits, each deposit at one of a

plurality of discrete cathodic or anodic regions at which one or more electrochemical reactions occurs; and

causing the one or more electrochemical reactions at each of the plurality of discrete regions whereby each of the one or more electrochemical reactions is measurable and quantifiable.

32. The process of claim 31 wherein the one or more electrochemical reactions that occur at each of the plurality of discrete regions is different from the other reactions.

33. The process of claim 31 wherein each of the one or more electrochemical reactions at each of the plurality of discrete regions proceeds simultaneously and for the same amount of time.

34. The process of claim 31 wherein the one or more electrochemical reactions occur simultaneously at different current densities at each of the discrete regions.

35. The process of claim 34 wherein the one or more electrochemical reactions cause a discrete deposit at each of the discrete regions, each discrete deposit being a function of the current density at the discrete region of the discrete deposit.

36. The process of claim 35 including the step of measuring the current density at each of the discrete regions while the one or more electrochemical reactions occur simultaneously at different current densities at each of the discrete regions.

37. The process of claim 35 including the step of measuring the voltage at each of the discrete regions while the one or more electrochemical reactions occur simultaneously at different current densities at each of the discrete regions.

38. A method for calculating electrochemical process parameters in an electrochemical device having a plurality of distinctly different cathodic or anodic regions including:

measuring currents and voltages while at least one electrochemical reaction takes place at different measurable rates on a plurality of distinctly different cathodic or anodic regions in the electrochemical device.

39. The method of claim 38 wherein the different reaction rates take place simultaneously on the distinctly different cathodic or anodic regions.

40. The method of claim 38, wherein the process parameters are selected from the group comprising the polarization curve and the kinetics constants of the electrochemical reaction.

41. The method of claim 38, wherein the parameters are selected from the group comprising the electrolyte conductivity and the equilibrium potential.

42. The method of claim 38 wherein the electrochemical process parameters are comprised of the reactant ion diffusivity.

43. The method of claim 38, wherein the plurality of reactions on each region are comprised of two primary reactions, one a deposition reaction and one a gas evolution reaction.

44. The method of claim 38 wherein calculating electrochemical process parameters includes:

weighing or measuring the thickness of the deposit; and

quantitative characterization of the current efficiency as function of the overall current or voltage.